

Ladies' Sanitary Association.




THE
TWO BREATHS.

BY
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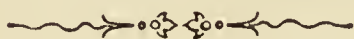


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THE TWO BREATHS.



LADIES,—I have been honoured by a second invitation to address you here,* from the lady to whose public spirit the establishment of these lectures is due. I dare not refuse it : because it gives me an opportunity of speaking on a matter, knowledge and ignorance about which may seriously affect your health and happiness, and that of the children with whom you may have to do. I must apologize if I say many things which are well known to many persons in the room : they ought to be well known to all ; and it is generally best to assume total ignorance in one's hearers, and to begin from the beginning.

* This address was delivered at Winchester, by the Rev. Charles Kingsley, and reprinted, by permission, from "Good Words."

I shall try to be as simple as possible ; to trouble you as little as possible with scientific terms ; to be practical ; and at the same time, if possible, interesting.

I should wish to call this lecture "The Two Breaths"—not merely "The Breath," and for this reason : Every time you breathe, you breathe two different breaths ; you take in one, you give out another. The composition of those two breaths is different. Their effects are different. The breath which has been breathed out must not be breathed in again. To tell you why it must not would lead me into anatomical details, not quite in place here as yet : though the day will come, I trust, when every woman entrusted with the care of children, will be expected to know something about them. But this I may say—Those who habitually take in fresh breath, will probably grow up large, strong, ruddy, cheerful, active, clear-headed, fit for their work. Those who habitually take in the breath which has been breathed out by themselves, or any other living creature, will certainly grow up, if they grow up at all, small, weak, pale, nervous, depressed, unfit for work, and tempted continually to resort to stimulants, and become drunkards. If you want to see how different the breath breathed out is from the

breath taken in, you have only to try a somewhat cruel experiment, but one which people too often try upon themselves, their children, and their work-people.

If you take any small animal with lungs like your own—a mouse, for instance—and force it to breathe no air but what you have breathed already ; if you put it in a close box, and while you take in breath from the outer air, send out your breath through a tube, into that box, the animal will soon faint ; if you go on long with this process, it will die.

Take a second instance, which I beg to press most seriously on the notice of mothers, governesses, and nurses : If you allow a child to get into the habit of sleeping with its head under the bed-clothes, and thereby breathing its own breath over and over again, that child will assuredly grow pale, weak, and ill. Medical men have cases on record of scrofula appearing in children previously healthy, which could only be accounted for from this habit, and which ceased when the habit stopped. Let me again entreat your attention to this undoubted fact.

Take another instance, which is only too common : If you are in a crowded room, with plenty of fire and lights and company, doors and windows all shut tight, how often you feel faint

—so faint, that you may require smelling-salts or some other stimulant. The cause of your faintness is just the same as that of the mouse's fainting in the box: you and your friends, and as I shall show you presently, the fire and the candles likewise, having been all breathing each other's breaths, over and over again, till the air has become unfit to support life. You are doing your best to enact over again the Highland tragedy, of which Sir James Simpson tells in his lectures to the working-classes of Edinburgh, when at a Christmas meeting, thirty-six persons danced all night in a small room with a low ceiling, keeping the doors and windows shut. The atmosphere of the room was noxious beyond description; and the effect was, that seven of the party were soon after seized with typhus fever, of which two died. You are inflicting on yourselves the torments of the poor dog, who is kept at the Grotto del Cane, near Naples—to be stupified, for the amusement of visitors, by the carbonic acid gas of the Grotto, and brought to life again by being dragged into the fresh air; nay, you are inflicting upon yourselves the torments of the famous Black Hole of Calcutta; and, if there was no chimney in the room, by which some fresh air could enter, the candles would soon burn blue (as they do, you know,

when ghosts appear), your brains become disturbed, and you yourselves run the risk of becoming ghosts, and the candles of actually going out.

Of this last fact there is no doubt; for if, instead of putting a mouse into the box, you will put a lighted candle, and breathe into the tube, as before, however gently, you will in a short time put the candle out.

Now, how is this? First, what is the difference between the breath you take in, and the breath you give out? And, next, Why has it a similar effect on animal life and a lighted candle?

The difference is this. The breath which you take in is, or ought to be, pure air, composed, on the whole, of oxygen and nitrogen, with a minute portion of carbonic acid.

The breath which you give out is impure air, to which has been added, among other matters which will not support life, an excess of carbonic acid.

That this is the fact you can prove for yourselves by a simple experiment. Get a little lime-water at the chemist's, and breathe into it through a glass tube, your breath will at once make the lime-water milky. The carbonic acid of your breath has laid hold of the lime, and

made it visible as white carbonate of lime—in plain English, as common chalk.

Now, I do not wish, as I said, to load your memories with scientific terms: but I beseech you to remember at least these two—oxygen gas and carbonic acid gas; and to remember that, as surely as oxygen feeds the fire of life, so surely does carbonic acid put it out.

I say “the fire of life.” In that expression lies the answer to our second question: Why does our breath produce a similar effect upon the mouse and the lighted candle? Every one of us is, as it were, a living fire. Were we not, how could we be always warmer than the air outside us? There is a process going on perpetually in each of us, similar to that by which coal is burnt in the fire, oil in a lamp, wax in a candle, and the earth itself in a volcano. To keep each of those fires alight, oxygen is needed; and the products of combustion, as they are called, are more or less the same in each case—carbonic acid and steam.

These facts justify the expression I just made use of (and which may have seemed to some of you fantastical), that the fire and the candles in the crowded room were breathing the same breath as you were. It is but too true. An average fire in the grate requires, I believe, to

keep it burning as much oxygen as three human beings do ; each candle or lamp must have its share of oxygen likewise, and that a very considerable one ; and an average gas-burner—pray attend to this, you who live in rooms lighted with gas—consumes as much oxygen as six candles or eleven men. All alike are making carbonic acid. The carbonic acid of the fire happily escapes up the chimney in the smoke ; but the carbonic acid from the human beings and the candles remains to poison the room, unless it be ventilated.

Now, I think you may understand one of the simplest, and yet most terrible, cases of want of ventilation—death by the fumes of charcoal. A human being shut up in a room, of which every crack is closed, with a pan of burning charcoal, falls asleep, never to wake again. His inward fire is competing with the fire of the charcoal for the oxygen of the room ; both are making carbonic acid out of it ; but the charcoal being the stronger of the two, gets all the oxygen to itself, and leaves the human being nothing to inhale but the carbonic acid which it has made. The human being, being the weaker, dies first ; but the charcoal dies also. When it has exhausted all the oxygen of the room, it cools, goes out, and is found in the morning half-consumed

beside its victim. If you put a giant or an elephant, I should conceive, into that room, instead of a human being, the case would be reversed for a time ; the elephant would put out the burning charcoal by the carbonic acid from its mighty lungs ; and then, when it had exhausted all the air in the room, die likewise of its own carbonic acid.

Now, too, I think we may see what ventilation means, and why it is needed.

Ventilation means simply letting out the foul air, and letting in the fresh air : letting out the air which has been breathed by men or by candles, letting in the air which has not. And, to understand how to do that, we must remember a most simple chemical law, that a gas as it is warmed expands, and therefore becomes lighter ; as it cools, it contracts, and becomes heavier.

Now the carbonic acid in the breath which comes out of our mouths is warm, lighter than the air, and rises to the ceiling ; and therefore in any unventilated room full of people, there is a layer of foul air along the ceiling. You might soon test that for yourselves, if you could mount a ladder and put your heads there aloft. You do test it for yourselves when you sit in the galleries of churches and theatres, where the air

is probably more foul, and therefore more injurious, than down below.

Where, again, work-people are employed in a crowded house of many storeys, the health of those who work on the upper floors always suffers most.

In the old monkey-house at the Zoological Gardens, when the cages were on the old plan, tier upon tier, the poor little fellows in the uppermost tier (so I have been told), always died first of the monkey's constitutional complaint, consumption, simply from breathing the warm breath of their friends below. But since the cages have been altered, and made to range side by side from top to bottom, consumption (I understand) has vastly diminished among them.

The first question in ventilation, therefore, is to get this carbonic acid safe out of the room, while it is warm and light, and close to the ceiling; for if you do not, this happens. The carbonic acid gas cools and becomes heavier—for carbonic acid, at the same temperature as common air, is so much heavier than common air, that you may actually (if you are handy enough) turn it from one vessel to another, and pour out for your enemy a glass of invisible poison. So down to the floor this heavy carbonic acid comes, and lies along it, just as it lies

often in the bottom of old wells, or old brewers vats, as a stratum of poison, killing occasionally the men who descend into it. Hence, as foolish a practice as I know is that of sleeping on the floor; for, towards the small hours, when the room gets cold, the sleeper on the floor is breathing carbonic acid.

And here one word to those ladies who interest themselves with the poor. The poor are too apt in times of distress to pawn their bedsteads and keep their beds. Never, if you have influence, let that happen. Keep the bedstead, whatever else may go, to save the sleeper from the carbonic acid on the floor.

How, then, shall we get rid of the foul air on the top of the room? After all that has been written and tried on ventilation, I know no simpler method than putting into the chimney one of Arnott's ventilators, which may be bought and fixed for a few shillings, always remembering that it must be fixed into the chimney as near the ceiling as possible. I can speak of these ventilators from twenty-five years' experience. Living in a house with low ceilings, liable to become overcharged with carbonic acid, which produces sleepiness in the evening, I have found that these ventilators keep the air fresh and pure; and I consider the presence of one

of these ventilators in a room more valuable than three or four feet additional height of ceiling. I have found, too, that their working proves how necessary they are, from this simple fact—You would suppose that as the ventilator opens freely into the chimney, the smoke would be blown down through it in high winds, and blacken the ceiling; but this is just what does not happen. If the ventilator be at all properly poised, so as to shut with a violent gust of wind, it will at all other moments keep itself permanently open, proving thereby that there is an up-draught of heated air continually escaping from the ceiling up the chimney. Another very simple method of ventilation is employed in those excellent cottages which her Majesty has built for her labourers round Windsor. Over each door a sheet of perforated zinc, some eighteen inches square, is fixed, allowing the foul air to escape into the passage, and in the ceiling of the passage a similar sheet of zinc, allowing it to escape into the roof. Fresh air, meanwhile, should be obtained from outside, by piercing the windows, or otherwise. And here let me give one hint to all builders of houses—if possible, let bedroom windows open at the top as well as the bottom.

Let me impress the necessity of using some

such contrivances, not only on parents and educators, but on those who employ work-people, and above all on those who employ young women in shops or in work-rooms. What their condition may be in this city, I know not: but most painful it has been to me in other places, when passing through warehouses or work-rooms, to see the pale, sodden, and as the French would say, "etiolated" countenances of the girls who were passing the greater part of the day in them; and painful, also, to breathe an atmosphere of which habit had, alas, made them unconscious, but which to one coming out of the open air was altogether noxious, and shocking also; for it was fostering the seeds of death, not only in the present but in future generations.

Why should this be? Every one will agree that good ventilation is necessary in a hospital, because people cannot get well without fresh air. Do they not see that by the same reasoning good ventilation is necessary everywhere, because people cannot remain well without fresh air? Let me entreat those who employ women in work-rooms, if they have no time to read through such books as Dr. Andrew Combe's "Physiology applied to Health and Education," and Madame de Wahl's "Practical Hints on the Moral, Men-

tal, and Physical Training of Girls," to procure certain tracts, published by Messrs. Jarrold, 3, Paternoster Buildings, for the Ladies' Sanitary Association; especially one which bears on this subject, "The Black Hole in our own Bedrooms;" Dr. Lankester's "School Manual of Health;" or a manual on ventilation, published by the Metropolitan Working Classes Association for the improvement of Public Health.

I look forward—I say it openly—to some period of higher civilization, when the acts of parliament for the ventilation of factories and workshops shall be largely extended, and made far more stringent; when officers of public health shall be empowered to enforce the ventilation of every room in which persons are employed for hire; and empowered also to demand a proper system of ventilation for every new house, whether in country or in town. To that, I believe, we must come: but I had sooner far see these improvements carried out, as befits the citizens of a free country, in the spirit of the Gospel rather than in that of the law—carried out not compulsorily and from fear of fines, but voluntarily, from a sense of duty, honour, and humanity. I appeal, therefore, to the good feeling of all whom it may concern, whether the health of those whom they employ, and there-

fore the supply of fresh air which they absolutely need, are not matters for which they are not more or less responsible to their country and their God.

And if any excellent person of the old school should answer me, "Why make all this fuss about ventilation? Our forefathers got on very well without it." I must answer that, begging their pardons, our ancestors did nothing of the kind. Our ancestors got on usually very ill in these matters: and when they got on well, it was because they had good ventilation in spite of themselves.

First, They got on very ill. To quote a few remarkable instances of longevity, or to tell me that men were larger and stronger on the average in old times, is to yield to the old fallacy of fancying that savages were peculiarly healthy, because those who were seen were active and strong. The simple answer is, that the strong alone survived, while the majority died from the severity of training. Savages do not increase in number; and our ancestors increased but very slowly for many centuries. I am not going to disgust my audience with statistics of disease: but knowing something, as I happen to do, of the social state and of the health of the middle and Elizabethan ages, I have no hesitation

in saying that the average of disease and death was far greater than it is now. Epidemics of many kinds, typhus, ague, plague—all diseases which were caused more or less by bad air, devastated this land and Europe in those days with a horrible intensity, to which even the choleras of our times are mild. The back streets, the hospitals, the jails, the barracks, the camps—every place in which any large number of persons congregated, were so many nests of pestilence, engendered by uncleanness, which defiled alike the water which was drank and the air which was breathed; and as a single fact, of which the tables of insurance companies assure us, the average of human life in England has increased twenty-five per cent. since the reign of George I., owing simply to our more rational and cleanly habits of life.

But secondly, I said that when our ancestors got on well, they did so because they got ventilation in spite of themselves. Luckily for them, their houses were ill-built, their doors and windows would not shut. They had lattice-windowed houses too, to live in one of which, as I can testify from long experience, is as thoroughly ventilating as living in a lantern with the glass broken out. It was because their houses were full of draughts, and still more, in the early

middle age, because they had no glass, and stopped out the air only by a shutter at night, that they sought for shelter rather than for fresh air, of which they sometimes had too much ; and to escape the wind, built their houses in holes, such as that in which the old city of Winchester stands. Shelter, I believe, as much as the desire to be near fish in Lent, and to occupy the rich alluvium of the valleys, made the monks of old England choose the river banks for the sites of their abbeys. They made a mistake therein, which, like most mistakes, did not go unpunished. These low situations, especially while the forests were yet thick on the hills around, were the perennial haunts of fever and ague, produced by subtle vegetable poisons, carried in the carbonic acid given off by rotting vegetation. So there again they fell in with man's old enemy, bad air. Still, as long as the doors and windows did not shut, some free circulation of air remained. But now, our doors and windows shut only too tight. We have plate glass instead of lattices ; and we have replaced the draughty and smoky but really wholesome open chimney, with its wide corners and settles, by narrow registers, and even by stoves. We have done all we can, in fact, to seal ourselves up hermetically from the outer

air, and to breathe our own breaths over and over again; and we pay the penalty of it in a thousand ways unknown to our ancestors, through whose rooms all the winds of heaven whistled, and who were glad enough to shelter themselves from draughts in the sitting-room by the high screen round the fire, and in the sleeping-room by the thick curtains of the four-post bedstead, which is now rapidly disappearing before a higher civilization. We therefore absolutely require to make for ourselves the very ventilation from which our ancestors tried to escape.

But, Ladies, there is an old and true proverb, that you may bring a horse to the water, but you cannot make him drink. And likewise, it is too true, that you may bring people to the fresh air, but you cannot make them breathe it. Their own folly, or the folly of their parents and educators, prevents their lungs being duly filled and duly emptied. Therefore, the blood is not duly oxygenated, and the whole system goes wrong. Paleness, weakness, consumption, scrofula, and too many other ailments, are the consequence of ill-filled lungs. For without well-filled lungs, robust health is impossible.

And if any one shall answer, "We do not want robust health so much as intellectual attainment. The mortal body, being the lower

organ, must take its chance, and be even sacrificed if need be, to the higher organ, the immortal mind :”—To such I reply, You cannot do it. The laws of nature, which are the express will of God, laugh such attempts to scorn. Every organ of the body is formed out of the blood ; and if the blood be vitiated, every organ suffers in proportion to its delicacy ; and the brain, being the most delicate and highly specialised of all organs, suffers most of all and soonest of all, as every one knows who has tried to work his brain when his digestion was the least out of order. Nay, the very morals will suffer. From ill-filled lungs, which signify ill-repaired blood, arise year by year an amount not merely of disease, but of folly, temper, laziness, intemperance, madness, and, let me tell you fairly, crime—the sum of which will never be known till that great day when men shall be called to account for all deeds done in the body, whether they be good or evil.

I must refer you on this subject again to Andrew Combe's "Physiology," especially chapters iv. and vii. ; and also to chapter x. of Madame de Wahl's excellent book. I will only say this shortly, that the three most common causes of ill-filled lungs, in children and in young ladies, are stillness, silence, and stays.

First, stillness ; a sedentary life, and want of exercise. A girl is kept for hours sitting on a form writing or reading, to do which she must lean forward ; and if her mistress cruelly attempts to make her sit upright, and thereby keep the spine in an attitude for which Nature did not intend it, she is thereby doing her best to bring on that disease so fearfully common in girls' schools, lateral curvature of the spine. But practically the girl will stoop forward. And what happens ? The lower ribs are pressed into the body, thereby displacing more or less something inside. The diaphragm in the meantime, which is the very bellows of the lungs, remains loose ; the lungs are never properly filled or emptied ; and an excess of carbonic acid accumulates at the bottom of them. What follows ? Frequent sighing to get rid of it ; heaviness of head ; depression of the whole nervous system under the influence of the poison of the lungs ; and when the poor child gets up from her weary work, what is the first thing she probably does ? She lifts up her chest, stretches, yawns, and breathes deeply—Nature's voice, Nature's instinctive cure, which is probably regarded as ungraceful, as what is called "lolling," is. As if sitting upright was not an attitude in itself essentially ungraceful, and such as no artist

would care to draw. As if "lolling" which means putting the body in the attitude of the most perfect ease compatible with a fully expanded chest, was not in itself essentially graceful, and to be seen in every reposing figure in Greek bas-reliefs and vases; graceful, and like all graceful actions, healthful at the same time. The only wholesome attitude of repose, which I see allowed in average school-rooms, is lying on the back on the floor, or on a sloping board, in which case the lungs must be fully expanded. I have seen that plan work much good, not only with girls, but with delicate boys, especially when combined with moderate reading aloud.

This last word brings me to the second mistake, enforced silence. I said moderate reading aloud, because where there is any tendency to irritability of throat or lungs, too much moderation cannot be used. You may as well try to cure a diseased lung by working it, as to cure a lame horse by galloping him. But where the breathing organs are of average health, let it be said once and for all, that children and young people cannot make too much noise. The parents who cannot bear the noise of their children have no right to have brought them into the world. The schoolmistress who enforces silence on her pupils is committing—uninten-

tionally no doubt, but still committing—an offence against reason, worthy only of a convent. Every shout, every burst of laughter, every song; nay, in the case of infants, as physiologists well know, every moderate fit of crying, conduces to health, by rapidly filling and emptying the lung, and changing the blood more rapidly from black to red, that is, from death to life. Andrew Combe tells a story of a large charity school, in which the young girls were, for the sake of their health, shut up in the hall and school-room during play hours, from November till March, and no romping or noise allowed. The natural consequences were, the great majority of them fell ill; and I am afraid that a great deal of illness has been from time to time contracted in certain school-rooms, simply through this one cause of enforced silence. Some cause or other there must be for the amount of ill-health and weakness which prevails especially among girls of the middle classes in towns, who have not, poor things, the opportunities which richer girls have, of keeping themselves in strong health by riding, skating, archery (that last quite an admirable exercise for the chest and lungs, and far preferable to croquet, which involves too much unwholesome stooping.) Even playing at ball, which has been popular ever since the time of old

Homer, who makes the Princess Nausicaa and her maidens play it on the sea shore, after they have washed the garments of the royal household—even a game of ball, I say—if milliners and shop-girls had room to indulge in one after their sedentary work—might bring fresh spirits to many a heart, and fresh colour to many a cheek.

I spoke just now of the Greeks. I suppose you will all allow that the Greeks were, as far as we know, the most beautiful race which the world ever saw. Every educated man knows that they were also the cleverest of all races; and next to his Bible, thanks God for Greek literature.

Now these people had made physical as well as intellectual education a science as well as a study. Their women practised graceful (in some cases even athletic) exercises. They developed, by a free and healthy life, those figures which remain everlasting and unapproachable models of human beauty: but (to come to my third point) they wore no stays. The first mention of stays that I have ever found is in the letters of dear old Synesius, Bishop of Cyrene, on the Greek coast of Africa, about four hundred years after the Christian era. He tells us how, when he was shipwrecked on a remote part of the coast, and

he and the rest of the passengers were starving on cockles and limpets, there were among them a slave girl out of the far East, who had a pinched wasp-waist, such as you may see on the old Hindoo sculptures, and such as you may see in any street in a British town. And when the Greek ladies of the neighbourhood found her out, they sent for her from house to house, to behold with astonishment and laughter, this new prodigious waist, with which it seemed to them it was impossible for a human being to breathe or live; and they petted the poor girl and fed her, as they might a dwarf or a giantess, till she got quite fat and comfortable, while her owners had not enough to eat. So strange and ridiculous seemed our present fashion to the descendants of those who, centuries before, had imagined because they had seen living and moving, those glorious statues which we pretend to admire, but refuse to imitate.

It seems to me that a few centuries hence, when mankind has learnt to fear God more, and therefore to obey more strictly those laws of nature and of science which are the will of God—it seems to me, I say, that in those days the present fashion of tight lacing will be looked back upon as a contemptible and barbarous superstition, denoting a very low level of civili-

zation in the peoples which have practised it. That for generations past women should have been in the habit—not to please men, who do not care about the matter as a point of beauty—but simply to vie with each other in obedience to something called fashion—that they should, I say, have been in the habit of deliberately crushing that part of the body which should be especially left free, contracting and displacing their lungs, their heart, and all the most vital and important organs, and entailing thereby disease, not only on themselves, but on their children after them—that for forty years past physicians should have been telling them of the folly of what they have been doing:—and that they should as yet, in the great majority of cases, not only turn a deaf ear to all warnings, but actually deny the offence, of which one glance of the physician or the sculptor, who know what shape the human body ought to be, brings them in guilty—this, I say, is an instance of—what shall I call it? which at once deserves the lash, not merely of the satirist, but of any theologian who really believes that God made the physical universe. Let me, I pray you, appeal to your common sense for a moment. When any one chooses a horse or a dog, whether for strength, for speed, or for any other useful purpose, the first

thing almost to be looked at is the girth round the lower ribs, the room for heart and lungs. Exactly in proportion to that will be the animal's general healthiness, power of endurance, and value in many other ways. If you will look at eminent lawyers and famous orators, who have attained a healthy old age, you will see that in every case they are men (like the late Lord Palmerston, and others whom I could mention) of remarkable size, not merely in the upper, but in the lower part of the chest; men who had, therefore, a peculiar power of using the diaphragm to fill and to clear the lungs, and therefore to oxygenate the blood of the whole body. Now it is just these lower ribs, across which the diaphragm is stretched like the head of a drum, which stays contract to a minimum. If you advised owners of horses and hounds to put their horses or their hounds into stays, and lace them up tight, in order to increase their beauty, you would receive, I doubt not, a very courteous, but certainly a very decided refusal to do that which would spoil not merely the animals themselves, but the whole stud or the whole kennel for years to come. And if you advised an orator to put himself into tight stays, he, no doubt, again would give a courteous answer; but he would reply (if he was a really educated man)

that to comply with your request would involve his giving up public work, under the probable penalty of being dead within the twelvemonth.

And how much work of every kind, intellectual as well as physical, is spoiled or hindered—how many deaths occur from consumption and other complaints which are the result of this habit of tight lacing, is known partly to the medical men, who lift up their voices in vain, and known fully to Him who will not interfere with the least of His own physical laws to save human beings from the consequences of their own wilful folly.

And now—to end this lecture with more pleasing thoughts—What becomes of this breath which passes from your lips? Is it merely harmful—merely waste? God forbid! God has forbidden that anything should be merely harmful or merely waste in this so wise and well-made world. The carbonic acid which passes from your lips at every breath—ay, even that which oozes from the volcano crater when the eruption is past—is a precious boon to thousands of things of which you have daily need. Indeed there is a sort of hint at physical truth in the old fairy tale of the girl, from whose lips, as she spoke, fell pearls and diamonds; for the carbonic acid of your breath may help hereafter to make the pure carbonate of lime of a pearl, or the still

purser carbon of a diamond. Nay, it may go (in such a world of transformations do we live) to make atoms of coal strata, which shall lie buried for ages beneath deep seas, shall be upheaved in continents which are yet unborn, and there be burnt for the use of a future race of men, and resolved into their original elements. Coal, wise men tell us, is on the whole breath and sunlight—the breath of living creatures who have lived in the vast swamps and forests of some primæval world, and the sunlight which transmuted that breath into the leaves and stems of trees, magically locked up for ages in that black stone, to become, when it is burnt at last, light and carbonic acid, as it was at first. For though you must not breathe your breath again, you may at least eat your breath, if you will allow the sun to transmute it for you into vegetables: or you may enjoy its fragrance and its colour in the shape of a lily or a rose. When you walk in a sunlit garden, every word you speak, every breath you breathe, is feeding the plants and flowers around. The delicate surface of the green leaves absorbs the carbonic acid, and parts it into its elements, retaining the carbon to make woody fibre, and courteously returning you the oxygen to mingle with the fresh air, and be inhaled by your lungs once more. Thus do you feed the plants, just

as the plants feed you, while the great life-giving sun feeds both ; and the geranium standing in the sick child's window does not merely rejoice his eye and mind by its beauty and freshness, but repays honestly the trouble spent on it, absorbing the breath which the child needs not, and giving to him the breath which he needs.

So are the services of all things constituted according to a Divine and wonderful order, and knit together in mutual dependence and mutual helpfulness.—A fact to be remembered with hope and comfort : but also with awe and fear. For as in that which is above nature, so in nature itself ; he that breaks one physical law is guilty of all. The whole universe as it were, takes up arms against him ; and all nature, with her numberless and unseen powers, is ready to avenge herself on him, and on his children after him, he knows not when nor where. He, on the other hand, who obeys the laws of nature with his whole heart and mind, will find all things working together to him for good. He is at peace with the physical universe. He is helped and befriended alike by the sun above his head and the dust beneath his feet : because he is obeying the will and mind of Him who made sun, and dust, and all things ; and who has given them a law which cannot be broken.

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